MADROÑO

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ERNEST BROWN BABCOCK

1877–1954

With the passing of Ernest B. Babcock in Berkeley, California, on December 8, 1954, the botanists of California lost one of their most distinguished colleagues and a kindly, warm-hearted friend.

Professor Babcock was best known to botanists as the author of one of the finest monographs in the field of plant science, his monumental work on *Crepis*. This work, which was the climax of thirty years of intensive research by himself and his associates, brought together a larger body of information about the systematics, cytogenetics, and evolution of a large genus than had ever been gathered before its publication in 1947. His remarkable collection of herbarium specimens of species of *Crepis* and related genera, part of them collected in the field, and part of them made from plants grown in the garden and greenhouse, was presented before his death to the Herbarium of the University of California. As the author of several new species of *Crepis,* he combined the meticulous attention to accuracy of detail which is necessary for a taxonomist with the vision and understanding which he used to excellent advantage in the ensuing long series of experiments and observations in the field of cytogenetics. Above all, he was an evolutionist. A deeply religious man, he looked upon the successive evolution of ever more varied forms of life as the strongest evidence which man can obtain regarding the master plan of the Creator.

Mr. Babcock was born in Edgerton, Wisconsin, on July 10, 1877. He came to California in 1896 with his parents, Emilus Welcome and Mary Eliza (Brown) Babcock. His interest in plants had already begun at that time, since he more than once told his friends about the enthusiasm with which, as a child, he tended the plants in his mother's conservatory. After graduating from the Los Angeles Normal School, he went to the University of California, where he remained for the rest of his life. He received the B.S. degree in 1905, and in 1907 was appointed to the University faculty, on which he served for forty years. In 1913, he became chairman of the newly founded Division of Genetics in the College of Agriculture, and retained that position until his retirement in 1947.

Professor Babcock was introduced to the flora of California by Harvey Monroe Hall, who became his friend during undergraduate years in Berkeley, and with whom he took several long botanizing trips in the High Sierra. Until Dr. Hall's death, he and Babcock were inseparable friends. They published together a systematic and genetic study of *Hemizonia,* and Dr. Hall's stimulus did much to inspire Professor Babcock to begin his study of *Crepis*.

In 1908, he married Georgia Bowen, a childhood friend and neighbor from Edgerton, Wisconsin. She survives him.

Professor Babcock's career is noted for a number of accomplishments in the field of Genetics and Plant Breeding. The most noteworthy of these

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Ernest Brown Babcock

was the authorship, with his colleague R. E. Clausen, of the textbook, Genetics in Relation to Agriculture. This work appeared in two editions, the first one in 1918 and the second in 1927. For many years it was a standard textbook in the field of Genetics. In his earlier years as a plant breeder he made the hybridizations which led to the production of the Babcock peach, a variety which until recent years was one of the foremost of the varieties suited to the warmer parts of California.

When Professor Babcock began his studies of the genus *Crepis* in 1920, the idea of using cytogenetic information to clarify taxonomic relationships was a novel one. The enthusiasm with which he and his associates embarked upon this project, the obvious value of even their earlier publications, and the striking clarity of the exhibits which he presented at various meetings of national scientific societies and international congresses did much to impress botanists with the importance of this type of work. To those botanists interested in evolution who attended the Sixth International Congress of Genetics at Ithaca in 1932, Professor Babcock's "Evolutionary Tree" of *Crepis,* with living plants of representative species and illustrations of their chromosomes placed side by side in order of their phylogenetic position, became a major center of interest, and made a lasting impression.

Not long after he had begun his studies of the Old World species of *Crepis,* he turned his attention to the much smaller number of species endemic to North America. He found there a pattern of relationships entirely different from that in the Old World, and based upon hybridization, polyploidy, and particularly apomixis. With characteristic thoroughness, and in collaboration with the present writer, he worked out the entire pattern of relationships among these species, and published this study as the first monographic contribution on the genus itself. Meanwhile, he had become interested in the genera related to *Crepis,* and either carried out himself or promoted the execution by his associates of a series of monographic studies which showed clearly the position of the genus within the family Compositae.

These preliminary monographic studies paved the way for the publication of the final great work, which coincided with Professor Babcock's retirement from the active faculty of the University of California. Professor Babcock's monograph of *Crepis* has been acclaimed by all who have used it as taxonomically sound, broad in scope, and meticulously accurate in execution. It will remain for many years as a classical model for monographic studies.

Professor Babcock's career did not end with his retirement. During the last seven years of his life, he devoted much energy toward advancing the cause of scientific research, both in connection with the California Academy of Sciences, of which he became President in 1953, and with the Institute of Forest Genetics at Placerville. As Vice-President of the Forest Genetics Foundation, he was the stimulus of a nation-wide movement to encourage research toward the utilization of the best germ plasm available in the restoring of our forest resources by replanting. This final activity emphasized one of Professor Babcock's outstanding qualities. For his inspiration he always looked toward the future rather than backward toward the past.

As might be expected of a scientist with such outstanding attainments, Professor Babcock belonged to a large number of scientific societies, and became an officer of many of them. He was President of the California Botanical Society in 1941, and of the Society for the Study of Evolution in 1952. He was a member of the American Society of Naturalists, the Washington Academy of Sciences, and the National Academy of Sciences. His Alma Mater recognized his preeminence in 1944 by awarding him the Faculty Research Lectureship and in 1947 by conferring upon him the honorary degree of LL.D.

All those who knew him, whether intimately or casually, whether as students, colleagues, or friends, recognized in Ernest Babcock an exceptional personality. His broad understanding of nature, combined with his kindliness, generosity, and faith in the goodness of all mankind created a feeling of good will among a wide circle of humanity.—G. L. STEBBINS, Division of Genetics, University of California, Davis.

SOME CONSIDERATIONS OF THE GENERA ECHINOCYSTIS AND ECHINOPEPON IN THE UNITED STATES AND NORTHERN MEXICO

Kenneth M. Stocking

The genera *Sicyos* and *Sicyoides* as originally proposed in 1737 by Linnaeus encompassed, in addition to the Old World species, what were later to be recognized as the New World genera *Echinocystis, Echinopepon,* and *Marah.* The present writer is treating these three New World genera herein and in a subsequent paper. In addition to these three genera the following key includes *Brandegea* and *Vaseyanthus,* two genera whose ranges coincide in part with those of *Echinopepon* and *Marah,* plants of which, in sterile condition, have often been confused with them.

Key to the Five Genera

1. Ovary 1-celled, ovule 1; fruit usually smooth or nearly so, less than 1 cm. long; perennial . . . . *Brandegea*
1. Ovary more than 1-celled, ovules more than one; fruits usually conspicuously spiny, more than 1 cm. long; annuals except *Marah*.
    2. Plants perennial, stems from large perennial tuber, seeds at least 7 mm. thick. . . . . *Marah*
    2. Plants annual, seeds less than 6 mm. thick.
        3. Sepals and petals 6; seeds large, 14–18 mm. long; northern Arizona, northern New Mexico and northeastern United States . . . *Echinocystis*
        3. Sepals and petals 5; seeds less than 10 mm. long; Mexico, southern Arizona, and New Mexico.
            4. Fruit globose; ovules normally 2; Lower California . . *Vaseyanthus*
            4. Fruit ovoid-cylindrical, ovules 4 or more, Argentina to Mexico, southern Arizona, and southern New Mexico . . . . *Echinopepon*

Echinocystis

In Hortus Cliffortianus, Linnaeus (1737, p. 452) gives "*Sicyos foliis angulatis*" and under it as a synonym includes Tournefort's "*Sicyoides americana, fructu echinato, foliis angulatis.*" The distribution is given as Canada, but one cannot be sure that either of these entities refers to what is now known as *Echinocystis lobata.*

Not until Michaux (1803) described *Sicyos lobata* was this species positively recognizable, but the genus *Sicyos* was later restricted to those cucurbitaceous plants having five-lobed corollas and one-seeded indehiscent fruits growing in firm clusters, so Muhlenberg (1805) published the combination *Momordica echinata* (Michx.) Muhl. In so doing he abandoned the specific name *lobata.* The next generic name applied to this plant was Rafinesque's *Micrampelis* (1808), but because of its inadequate description it has been rejected by most students of this group as a *nomen confusum.* Torrey (1840) erected the genus *Hexameria* for this entity, but later that year, upon finding this name preoccupied, Torrey and Gray (1840) proposed the name *Echinocystis.* Bentham and Hooker (1876) included in the genus *Echinocystis* all the then known species of the genera which we here recognize as *Echinocystis, Echinopepon,* and *Marah.* They considered the perennial California group to be a subgenus. Cogniaux (1878) divided *Echinocystis* into Section I, *Euechinocystis,* which includes the species *lobata* and *oregona;* and Section II, *Echinopepon,* which includes several species here treated as part of the genus *Echinopepon.* Three years later he divided *Echinocystis* into the three sections *Echinopepon, Euechinocystis,* and *Marah.* These sections are given generic standing by the present writer. [Specimens cited in this study were assembled in the herbarium of the University of Southern California, Los Angeles. Abbreviations used in citations are those proposed by Lanjouw (1954). In addition, KMS refers to the private herbarium of the author.]

ECHINOCYSTIS Torr. and Gray, Fl. N. Am. 1: 542. 1840. *Sicyos lobata* Michx. Fl. Bor. Am. 2: 217. 1803. Type: "in western Pennsylvania, by [the] Ohio River." *Micrampelis* Raf., Med. Rep. 5: 350. 1808, *nomen rejiciendum.* Description eleven words long and inadequate. *Hexameria* Torr., Rep. Pl. N. Y., 4: 137. 1840; not *Hexameria,* R. Br. in Bennett, Plant. Jav. Rariores, 1838. *Echinocystis* (section *Euechinocystis*) Cogn., Mem. Acad. Sci. Belg. 28: 87. 1878.

Plants annual. Seeds 2–3 mm. thick, 14–18 mm. long. Petals 6. A monotypic genus. Type: *Sicyos lobata* Michx.

ECHINOCYSTIS LOBATA (Michx.) Torr. and Gray, Fl. N. Am. 1:542. 1840. *Sicyos lobata* Michx. Fl. Bor. Am. 2:217. 1803. *Momordica echinata* Muhl., Wildenow Spec. 4:605. 1805. This description is dated two years after Michaux's so the name *M. echinata* is invalid. *Micrampelis echinata* (Muhl.) Raf. Med. Rep. 5:350. 1808. *M. lobata* Greene, Pittonia 2:128. 1890. *Echinocystis echinata* (Muhl.) Britt. Sterns and Pogg. Cat. 1882.

Roots annual with branching secondary roots; stems glabrous or nearly glabrous, climbing or trailing, much-branched, length to 6 m., diam. 1.5–3 mm., the internodes 5–15 (20) cm. long; leaf blades cordate, 5–10 (15) cm. in diam., deeply 5-lobed, the basal sulcus angular to broad and open, 3–15 mm. deep, the apices slender, acute, mucronate, seldom acute, the 3 to 5 lobes broadly triangular to lanceolate, the margins entire, denticulate to somewhat serrate, upper surfaces slightly scabrous to minutely pubescent, the lower almost glabrous; tendrils 3-fid, glabrous, on peduncles 3–5 cm. long; staminate flowers in many-flowered panicles (5) 15–20 (25) cm. long, the racemes of panicles 0.5–3 (15) cm. long, with to 15 flowers each; peduncle and its branches slightly pubescent; pedicels 2–8 (12) mm. long; calyx lobes 6, 2 mm. long, alternate with corolla lobes; corolla inserted on calyx, tube whitish, broadly campanulate 1–1.5 mm. long, 2–3 mm. broad, the lobes deeply parted, greenish-white or white, erect, spreading and linear-lanceolate, five-nerved, sub-obtuse, 4–5 mm. long, 0.75–1 mm. wide at base; stamens with anther heads cylindrical, to 1 mm. long, 0.6–0.8 mm. in diam., 3 locules readily visible, the filament column 0.4 mm. long, 0.17 mm. in diam.; pistillate flowers 1 to several in axil of staminate inflorescence, usually only 1 mature fruit per node; perianth structure much like that of staminate flowers, tube 1–1.5 mm. long; calyx lobes filiform, 4–5 mm. long; corolla lobes linear-lanceolate, sub-acute, 13–14 mm. long, 1 mm. wide at base; stigma sub-globose, 0.8 mm. in diam., nearly sessile; carpels 2, ovules 2 per carpel; fruit cylindrical-globose, glabrous, 4–5 cm. long, 2.5–3.5 cm. in diam., dehiscing irregularly at apex upon maturity, sparsely covered with slender, glabrous spines, these 3–8 mm. long; peduncle 6–10 (25) mm. long, glabrous; seeds flattened, squash-like, apices obtuse or acute; bases slightly narrowed, truncate, greyish-brown, sometimes slightly mottled and ridged, 14–18 mm. long, 7–8 mm. wide, 2–3 mm. thick.

Type. ". . . in western Pennsylvania, by [the] Ohio River." The following near-topotype represents our concept of the species and may be taken as a lectotype until such time as some other specimen, historically with better claim to this status, may be located. *T. F. Lucy 3452* (US 966366! photographs KMS! fig. 1).

The genus *Echinocystis* occurs in temperate North America principally east of the Rocky Mountains, and mostly north of the Ohio River in the United States and in southern Canada; apparently escaped from cultivation in various western states (fig. 5).

Representative specimens seen. Arizona. Coconino County: Flagstaff, Aug. 20, 1916, *Thornber 8579* ARIZ. Colorado. Arapahoe County: Clear Creek, Denver, Aug. 7, 1916, *Bettel* CAS; along Platte River, Denver, elev. 5,000 feet, Aug. 17, 1878, *Jones 640* POM. Larimer County: Fort Collins, elev. 5,000 feet, Aug. 28, 1894, *Baker* POM. Idaho. Ada County: stream bank, Boise, elev. 2,880 feet, Sept. 9, 1911, *Clark 324* DS, GH, POM, US. Illinois. Champaign County: on fences of Crystal Lake Park, Urbana, Sept. 23, 1907, or 1917, *Gates 1995* US. Cook County: South Chicago, 76th St., Aug. 20, 1913, *Smith 5778* GH. De Kalb County: rich soil along river, July-Sept., *Abbott* CAS. Indiana. Marshall County: near Lake Maxinkuckee, Aug. 24, 1900, *Scovell & Clark* DS. Iowa. Dickinson County: Lakeville Township, Section 2, Aug. 11, 1934, *Hayden 2033* GH. Emmet County: woods along stream, 1883, *Cratty* DS. Kansas. Riley County: 1896, *Norton 179a* GH. Maine. Androscoggin County: shore, Auburn, Sept. 19, 1893, *Allen* GH. Massachusetts. Middlesex County: along Merrimac River, Lowell, Aug. 8, 1927, *Beattie* POM; low bank of Alewife Brook, Cambridge, Aug. 17, 1934, *Smith & Drew 687* ARIZ, CAS, DS, LA, POM. Suffolk County: Boston, *Brandegee* DS. Michigan. Ingham County: Lansing, Aug. 27, 1891, *Toumey* ARIZ. Kent County: Grand Rapids, Aug. 11, 1890, *G.D.S.* CAS. Minnesota. Goodhue County: Zumbrota, Aug., 1892, *Ballard* DS, GH. Hennipin County: thickets, north hillside of cemetery, Minneapolis, Sept., 1893, *Perkins* USC. Winona County: river bottoms, July, 1889, *White* POM. Montana. Lake County: Ravalli, elev. 3,000 feet, Aug. 2, 1909, *Jones* POM. Nebraska. Franklin County: Franklin, Aug. 18, 1929, *Hapeman* POM. Lancaster County: wet ground, Lincoln, north salt lake, elev. 1,160 feet, Aug. 14, 1948, *Kiener 14970* GH. Nemaha County: woody bank, Peru, Sept. 28, 1934, *Winter 99* US. New Hampshire. Coos County: Gorham, Aug. 19, 1908, *Moore 4283* POM. New Jersey. Bergen County: Jersey City, Sept., 1900, *Dautun* LA. New Mexico. San Miguel County: Las Vegas, Gallinas River, Aug., 1927 UC; vicinity of Las Vegas, Sept., 1919, *Anect 1* US. New York. Albany County: banks of reservoir, Switzerland, Aug. 10, 1939, *House 26894* CAS. Chemung County: banks of Chemung River, Sept. 8, 1896, *Lucy 3452* US. Greene County: wet ground, Big Hollow, elev. 1,700 feet, Aug. 20, 1897, *Barnhart 2389* US. Tompkins County: rich moist low ground, Ithaca, Aug. 9, 1916, *Munz 343* POM. North Dakota. Benson County:

Leeds, Sept. 2, 1906, *Lunell* DS. Burleigh County: Bismark, Aug. 14, 1927, *Larsen 169* GH. McHenry County: river banks, Souris River, Towner, July 31 and Sept. 10, 1913, *Leeds* US. OHIO. Highland County: waste bottom land, Hillsboro, Sept. 27, 1935, *Demaree 11580* US. Lorain County: Elyria Aug., 1894, *Dick* DS. Pickaway County: river bottoms, Scioto and Circleville, Sept. 2, 1935, *Demaree 11659* DS, US. OREGON. Marion County: thicket along Mill Creek, Salem, "introduced?", Sept. 13, 1919, *Nelson, 2934* GH. PENNSYLVANIA. Philadelphia County: western Philadelphia, Oct. 1, 1926, *Adams 616* GH. RHODE ISLAND. Providence County: Providence, Aug. 22, 1878, *Stanford* POM. SOUTH DAKOTA. Lincoln County: Sioux River Basin, Aug. 11, 1892, *Thornber* ARIZ. Roberts County: Big Stone Lake, Aug., 1894, *Griffiths & Slosser 257* CAS. Union County: rich alluvium along edge of timber, Aug. 18, 1898 DS. VERMONT. Caledonia County: St. Johnsbury, Aug. 14, 1874, *Stanford* DS. Rutland County: alluvial banks and waste places, frequent, Middletown Spring, Aug. 5, 1934, *Carpenter* CAS. WASHINGTON. Whatcom County: escaped, Sumas, Aug. 21, 1937, *Muenscher 8386* GH. WEST VIRGINIA. Greenbrier County: low ground along stream 2 miles west of White Sulphur, Aug. 12, 1922, *L. & F. Randolph 1228* GH. WISCONSIN. Brown County: De Pere, Aug. 1, 1888, *Kellogg* US. Buffalo County: wooded summit, Eagle Bluff, Fountain City, Aug. 25, 1927, *Fassett & Wilson 5502* USC. Rock County: Beloit, *Swezey* CAS. Sheboygan County: Sheboygan, 1874, *Swezey*. Winnebago County: Oshkosh, July 30, 1909, *Clemens* POM. WYOMING. Yellowstone Park: Meldrum Gulch near Mammoth Hot Springs, Sept. 13, 1902, *Mearns 3967* US. CANADA: SASKATCHEWAN, 1857–8, *Bourgeau* GH. QUEBEC. Longuevil, Ile Plate, near Montreal, Oct. 28, 1928, *Marie-Victorin 28267* GH. NOVA SCOTIA. Colchester County: Aug. 26, 1927, *Prince & Atwood 732* DS. ONTARIO. Bruce County: Tobermory Village. Bruce Peninsula, Sept. 2, 1933, *Krotkoy 7824* GH.

Germination of seeds of *Echinocystis lobata,* although long known to be difficult, has been accomplished by the writer. The cotyledons, which were raised far above the soil surface where they became long and green, continued to function as leaves for forty days. They turned yellow at about the same time that the lowest pair of true leaves started to lose their function. It has been effectively demonstrated that "after-ripening" is necessary for the germination of the seeds of *Echinocystis lobata.*

ECHINOPEPON

Naudin (1866) described the genus *Echinopepon* on the basis of his observations of plants grown in the Museum of Natural History in Paris. Cogniaux (1878) first recognized *Echinopepon* as one of two, and later as one of three, sections of *Echinocystis.* Rose (1897) and writers of floras have for the last fifty years rather consistently considered *Echinopepon* as a genus separate from but allied to *Marah* and *Echinocystis.* Reference to the distributional maps reveals that the species dealt with in this treatment are centered on the plateau and toward the western coast of Mexico, while those not included herein, appear, from preliminary studies to be concentrated near and south of Mexico City.

ECHINOPEPON Naud. Ann. Sci. Nat. Bot. ser. 5,6:17. 1866. Type: *Marah horridus* Naud., designated here. *Echinocystis* (section *Echinopepon*) Cogn., Mem. Acad. Sci. Belg. 28:87. 1878; D.C. Monogr. Phan. 3:800, based on *Echinopepon* Naud. *Elaterium* O. Ktze., *pro parte typica,* Rev. Gen. 1: 257. 1891, in synonymy.

Roots annual, taproot with branching secondary roots. Stems glabrous to vestite, climbing or trailing, mostly slender, vertically striated. Leaf blades thin, cordate, almost entire, to more or less deeply 3 to 7- mostly 5-lobed, basal sulci open to almost closed; petioles one-half as long as to as long as leaves. Tendrils bifid or trifid, on peduncles about equal to petiole length. Staminate flowers in racemes, occasionally in panicles; caducous, pedicels persistent; corolla inserted on calyx; calyx lobes small, alternate with larger corolla lobes; corollas campanulate or rotate (4) 5 (6)-merous; anthers 5, almost fused, or fused into globose or discoid head; filaments fused. Pistillate flowers solitary, occasionally in 2's or 3's, from same nodes as staminate inflorescences, larger than staminate flowers. Ovary 2-celled, 2–5 ovules per cell; ovules erect, seldom horizontal. Fruits ovoid or ellipsoidal; beak slender, tapering to point, usually circumscissile, operculate, and conspicuously spiny. Seeds 2–5 per carpel, usually quadrangular, flattened, more or less rugose, dark. This description applies only to the species included in this paper.

Key to the Five Species of Echinopepon

1. Fruit more than 15 mm. in diameter; petiole hairs 1 mm. or more long. . . . . 1. *E. horridus*
1. Fruit less than 15 mm. in diameter; petiole hairs less than 1 mm. long.
    2. Petal apices quite obtuse, often emarginate; seeds with a conspicuous elliptical depression both in dorsal and in ventral surfaces. . . . 2. *E. coulteri*
    2. Petal apices acute or slightly obtuse; seeds without a conspicuous elliptical depression in dorsal and ventral surfaces.
        3. Fruiting peduncles filiform, more than 4 cm. long when mature, more or less coiling; seeds 4.5-5 mm. long. . . . . . . 5. *E. cirrhopedunculatus*
        3. Fruiting peduncles not filiform, less than 3.5 cm. long when mature, not coiling.
            4. Fruits 2–3 cm. long; seeds 5–7 mm. long. . . . . . . 3. *E. wrightii*
            4. Fruit less than 2 cm. long; seeds less than 4.5 mm. long, with thin, frequently twisted beak. . . . . 4. *E. minimus*

1. **Echinopepon horridus** Naud., Ann. Sci. Nat. Bot. ser. 5,6:19. 1866. Type: Naudin, Paris Botanical Garden from seeds obtained by Bourgeau [in Mexico]. (Isotype GH! photographs, KMS! fig. 1.)

Echinocystis (section *Echinopepon*) *lanatus* Cogn., Mem. Acad. Sci. Belg. 8,28:92. 1878. Type: *Galeotti,* without number, Herbarium of Horticulture, Bruxell, not seen; photograph (US!). *Micrampelis lanata* O. Ktze., Rev. Gen. 1:257. 1891, in synonymy. *Echinopepon lanatus* (Cogn.) Rose, Contr. Nat. Herb. 5:117. 1897, in synonymy.

Echinopepon jaliscanus Rose, Contr. U.S. Nat. Herb. 5:117. 1897. Type: Tequila, State of Jalisco, Mexico, *Pringle 4563* (US! photograph KMS!; UC! DS! GH!)

Stems up to 4 mm., sparsely villous, the internodes (7) 10–20 (30) cm. long; leaf blades cordate, (6) 8–10 (12) cm. wide, not quite as long, 3–5 (7) lobed, lobes usually short, the apices acute or obtuse, that of the central lobe often more acute than the others, the basal sulcus to 4.5 cm. broad, about half as deep, the margins almost entire to somewhat den-

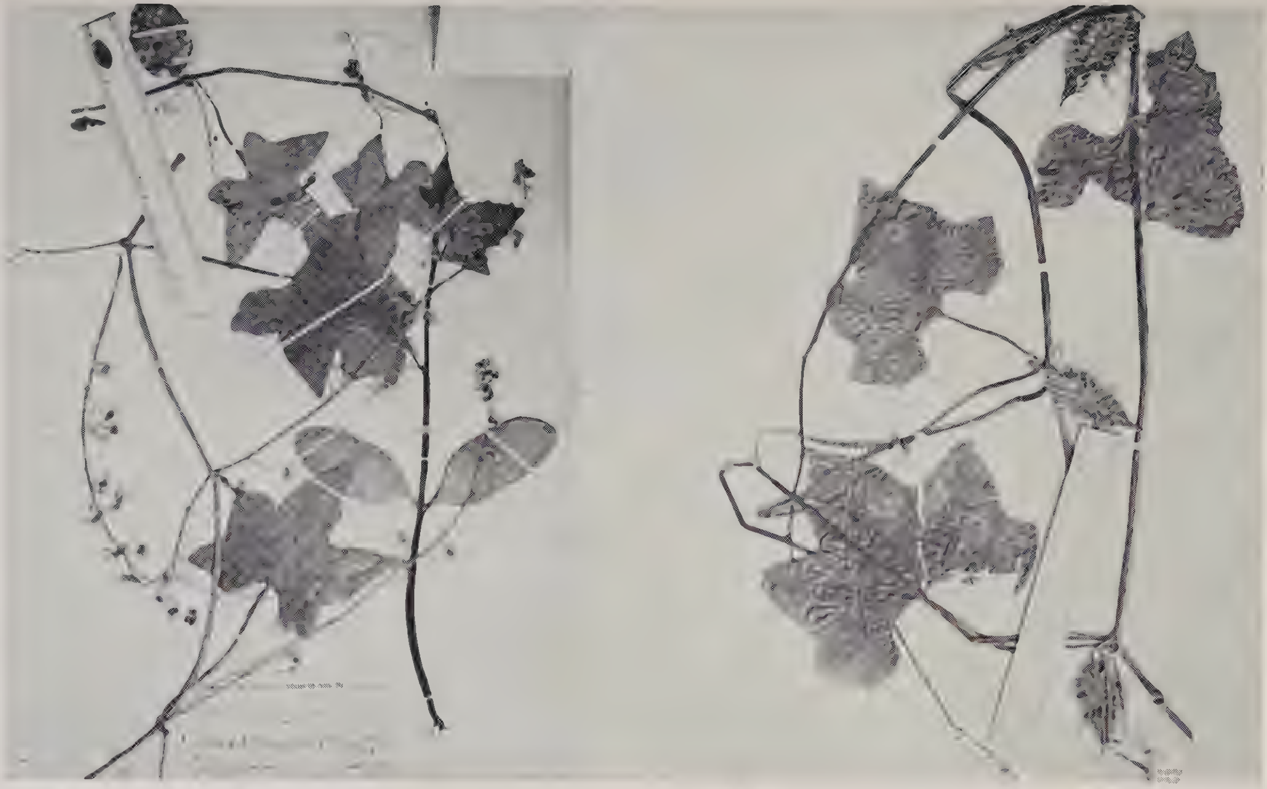

FIG. 1. *Echinocystis lobata*, lectotype, *Lucy 3452* US (left); *Echinopepon horridus*, isotype *Naudin* from seeds by Bourgeau GH (right)

ticulate the upper surfaces thickly to sparsely pubescent, lower less so; petioles 5–12 (20) cm. long, densely lanate; tendrils trifid (bifid), heavy, sparsely pubescent; peduncles 3–8 cm. long, pubescent; staminate flowers 15–25 per raceme, racemes 15–30 (40) cm. long, sparsely villous; pedicels 8–12 (15) mm. long; calyx lobes quite variable, broadly lanceolate, acuminate to deltoid, 0.67 to 2 (3) mm. long, 0.33 to 1.33 mm. wide at base, often with 3 greenish vertical lines, outer surface sparsely pubescent; corolla campanulate, basal portion flattened, the tube to 5 mm. long, often greenish and with 10 green vertical lines, the lobes deltoid, or sides slightly longer than the base, inner surfaces glandular-stipitate; stamens with anther head globose-cylindrical, 1.33 to 2 mm. in diam., to 2 (3) mm. long, upper third of each anther free in young flowers, the filament column 1–2 (3) mm. long, 0.2–0.4 mm. in diam.; pistillate flowers solitary or geminate, to 14 (15) mm. in diam., much shorter than wide; corolla campanulate, with flat base, multicellular trichomes within, lobes broadly subulate or deltoid, to 6 mm. long and 3.75 mm. across the base; stigma flattened-discoid, or globose, 2.33–3 mm. in diam., 0.75–1.33 mm. thick; style 2–3 (3.5) mm. long, 0.25–0.5 mm. in diam.; fruit heavy, oblong-obovoid, including beak 3–4.5 cm. long, 2–3 cm. in diam., beak (1.5) 2–3 cm. long, fruit and beak pubescent, the spines heavy, to 17 mm. long, bases to 3 mm. broad; peduncles nearly sessile, to 1.5 (2) cm. long; seeds oblong-elliptical in outline, 7–8 mm. long, 5–6 mm. wide, 2.5 mm. thick, apex tridentate, brownish, shallowly rugose.

In western Mexico from Baja California and Sinaloa, south to Costa Rica (fig. 5).

Representative specimens seen. MEXICO. BAJA CALIFORNIA: Arroyo Hondo, near Comondu, Oct. 22, 1893, *Brandegee* UC. JALISCO: Bolaños, Sept. 10–19, 1897, *Rose 2857* US; Tequila, Sept. 30, 1893, *Pringle 4563* DS, GH, UC, US. MEXICO: barranca, 880 meters, Anonas, Temascaltepec, Nov. 15, 1933, *Hinton 5211* GH; Limones, District of Temascaltepec, Oct. 3, 1932, *Hinton 1968,* GH. MICHOACAN: hill west of Jaconia, Oct. 17, 1940, *Moore 134* GH. NAYARIT: open, partially overflowed country, 50 meters south of Ruiz, Oct. 24, 1926, *Mexia 982* CAS, GH, UC; roadside shrubbery 1 mile from Tepic on the Puga road, Nov. 5, 1925, *Ferris 5775* DS. OAXACA: De La Laguna a Ojitalan, 350 meters, Distrito de Tuxtapec, Oct. 21, 1919, *Conzatti 3756* GH. SINALOA: Culiacan, Sept. 17, 1904, *Brandegee* UC. VERA CRUZ: Escamella near Orizaba, Oct. 7, 1866, *Bourgeau* GH. COSTA RICA: Cartago, elev. 4,250 feet, Nov., 1887, *Cooper 5775* GH, US; San Jose, Nov. 18, ?, *Pittier & Durand 1390* US. GUATEMALA: Coban, Dept. Alta Verapaz, Dec., 1886, *von Turckheim 1099* GH, US.

2. ECHINOPEPON COULTERI (Gray) Rose, Contr. U.S. Nat. Herb. 5:116. 1897. *Elaterium coulteri* Gray, Pl. Wright. [Smiths. Contr. Knowl.] 5, part 2:61. 1853. Type: Zacatecas, Mexico, *Coulter 51* (GH!) photographs KMS! fig. 2. *Echinocystis* (section *Echinopepon*) *coulteri* (Gray) Cogn., Mem. Acad. Sci. Belg. 28:88. 1878. *Micrampelis coulteri* (Gray) O. Ktze., Rev. Gen. 1:257. 1891.

Echinopepon confusus Rose, Contr. U.S. Nat. Herb. 5:115. 1897. Type: Pinos Altos Mts. [Grant County, New Mexico], Sept. 16, 1880, *E. L. Greene* (US! photograph KMS!)

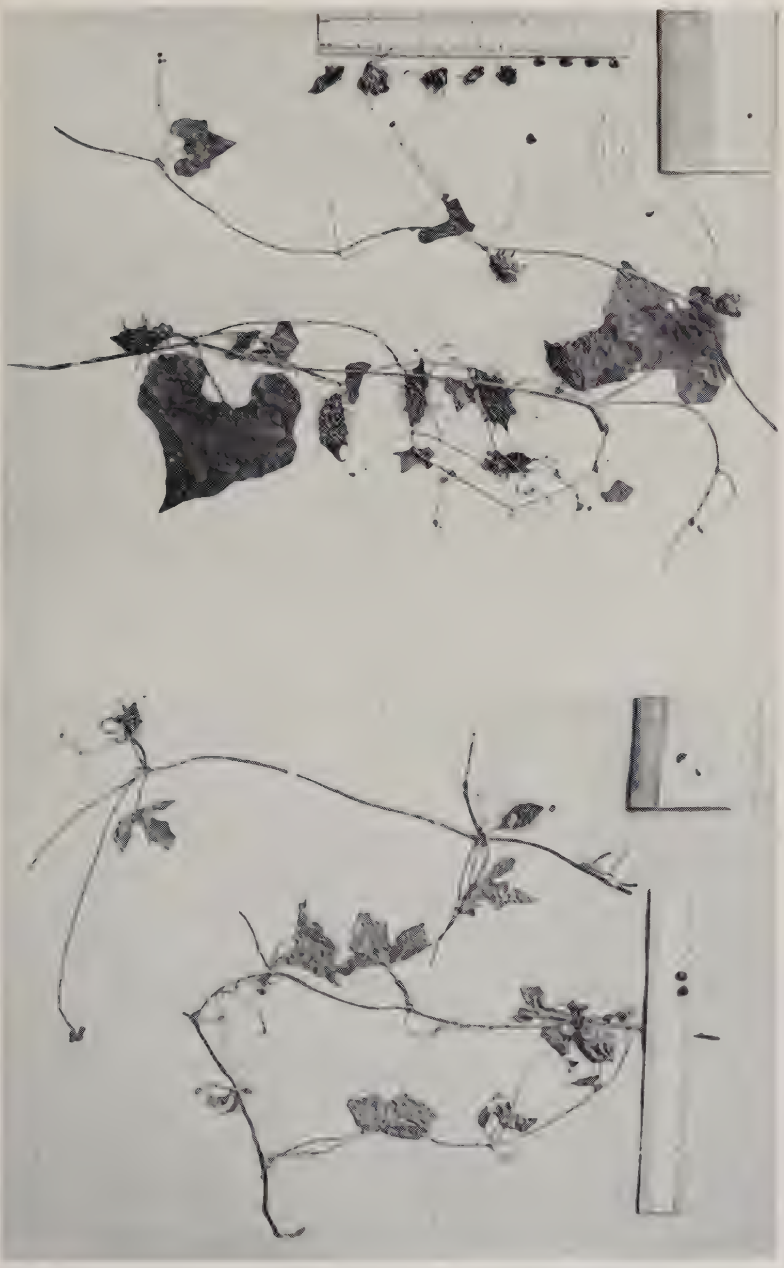

FIG. 2. *Echinopepon coulteri*, type, *Coulter 51* GH (left), *E. wrightii*, type, *Wright 1090* GH (right).

Echinopepon nelsoni Rose, Contr. U.S. Nat. Herb. 5:117. 1897. Type: "in the valley about Cuicatlan," State of Oaxaca, *Nelson 1878* (US!; Cotype GH! [*Gonzales 36,* Dec., 1895]; photograph KMS!)

Echinopepon parvifolius Rose, Contr. U.S. Nat. Herb. 5:118. 1897. Type: Huitzo, Oaxaca, *Conzatti 139* (GH, photographs; isotype US!)

Stems slender, to 1.5 mm. in diam., sparsely pubescent, the internodes 6–15 cm. long; leaf blades round-cordate, to 5 (7) cm. wide; 3–5 (7) cm. long, deeply or occasionally shallowly 3–5 lobed, the apices obtuse to acuminate, the basal sulci 1.5 cm. deep, 1.5–2 cm. wide, the margins entire to slightly sinuate-denticulate, the upper surfaces, especially along veins, hispid, the lower less so; petioles 2–5 (7) cm. long, pubescent; tendrils trifid on peduncles to 1.5–3 cm. long; staminate flowers to 15 per raceme, racemes to 14 (20) cm. long; pedicels 9–12 mm. long, slightly pubescent, several pedicels arising from one point; calyx lobes filiform-lanceolate, 0.4 to 1 mm. long, often greenish and thick; corolla campanulate, 10–12 mm. in diam., the lobes oblong or deltoid, to 5 mm. long and 2 (3) mm. wide at base, obtuse to emarginate, surfaces glabrous or with outer surfaces slightly pubescent; stamens with anther-head globose-flattened, 1 mm. in diam., definitely grooved, the anther column 0.2–0.33 mm. in diam., to 1.5 mm. long; pistillate calyx lobes filiform to subulate, 0.5 to 1.5 mm. long; corolla campanulate, 8–12 mm. in diam., lobes oblong-deltoid, often spatulate, 5–6 mm. long, 2.5–3 mm. wide at the base, apices obtuse, often emarginate; stigma globose, flattened, more rounded above than below, 1.2 to 1.5 mm. in diam., 0.5–1 mm. high, very slightly pubescent; style slender, 1.2–1.5 mm. long, 0.25–0.33 mm. in diam.; fruit obovoid, exclusive of beak, 20–30 mm. long, 12 mm. in diam., beak 5–8 mm. long, fruit and beak pubescent; spines to 5 mm. long, to 0.2 mm. in diam., pubescent; peduncle 1–2 (2.5) long, pubescent; seeds oblong-ovate, to 4.7 mm. long, 4 mm. wide, 2 mm. thick, brownish-black, rugose with conspicuous vertical elliptic depression on 2 largest surfaces, the apex flattened, rough.

In the United States in New Mexico, south on the Mexican plateau from Chihuahua to Oaxaca (fig. 5).

Representative specimens seen. UNITED STATES. NEW MEXICO. Donna Ana County: chiefly in the valley of the Rio Grande, below Donana, prior to 1888, *Emory 317* US. Grant County: Pinos Altos Mountains, August, 1880, *Greene* POM; Pinos Altos Mountains, Sept. 16, 1880, *Greene* GH. Hidalgo County: Copper Mines, Oct., 1851, *Thurber 1122* GH; limestone hills, elev. 6,600 feet, Kingston, Sept. 14, 1904, *Metcalfe 1348* CAS, GH, POM, US. Socorro County: Magdalena Mountains, elev. 6,500 feet, Aug. 30, 1909, *Goldman 1665* US. MEXICO. CHIHUAHUA: Santa Clara Mountains, Oct. 10–19, 1935, *Lesueur 419* GH, UC. DURANGO: city of Durango, April-Nov., 1896, *Palmer 856* UC, US; steep rocky volcanic slopes with oak, coarse grass, elev. 2,000 meters, Canyon Cantero, Sierra Gamon, Sept. 21, 1948, *Gentry 8384* AHFH. HIDALGO: Pachuca, elev. 8,050 feet, July 19, 1935, *Fisher 35289* ARIZ, GH. OAXACA: Cuicatlan, elev. 1,600 feet, Dec. 10, 1895, *Gonzalez 36* GH; valley above Cuicatlan, elev. 1,800 feet, Nov. 3, 1894, *Nelson 1878* US; Huitzo, elev. 1,600 meters, Oct. 1, 1895, *Conzatti 139* GH, US; Sierra de San Felipe, elev. 7,500 feet, Oct. 5, 1894, *Pringle 4958* GH, UC. PUEBLA: Cerro del Corral de Piedra, elev. 8,000-9,000 feet,

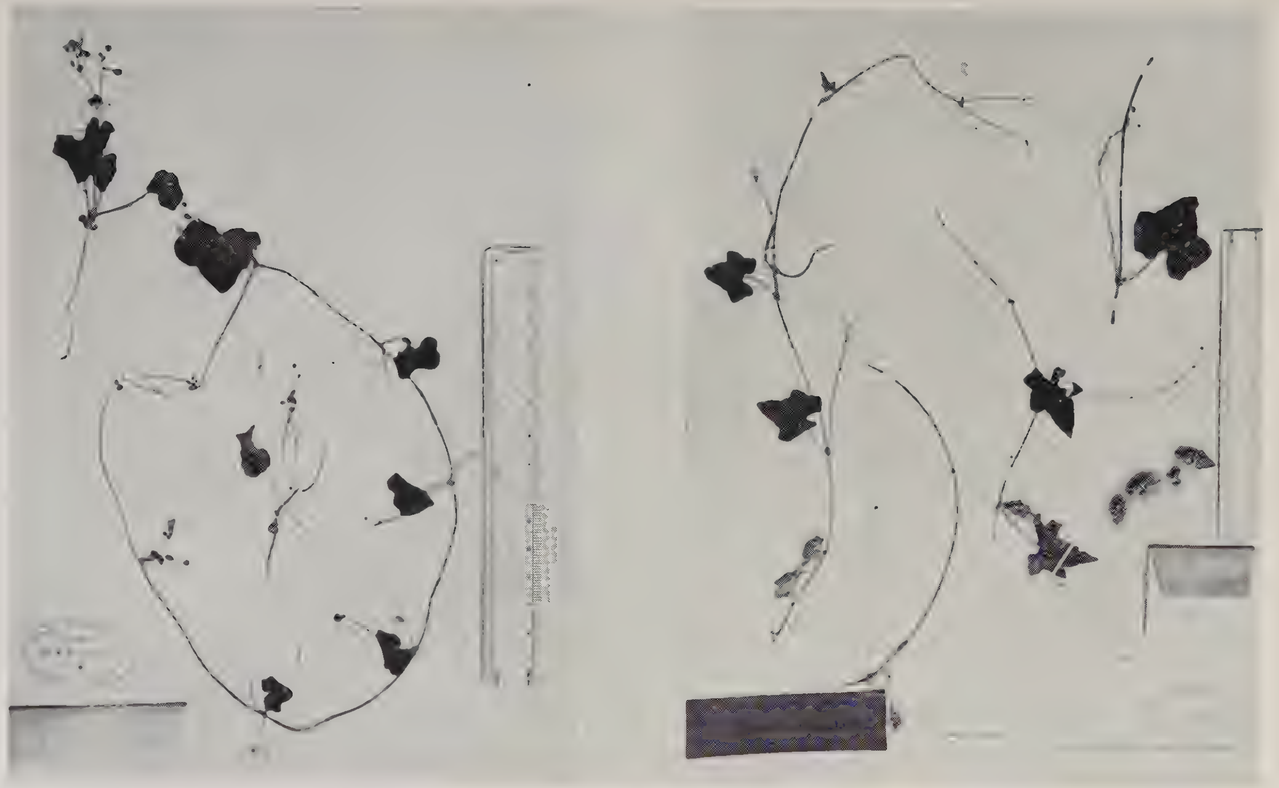

FIG. 3. *Echinopepon minimus* var. *minimus*, duplicate of lectotype, *Streets* GH (left). *E. cirrhopedunculatus*, type, *Palmer 634* US (right).

Aug., 1909, *Purpus 4222* UC; vicinity of San Luis Tultitlanapa, near Oaxaca, July, 1908, *Purpus 3548* GH, UC. ZACATECAS: between Colotlan and Plateado, Aug. 31, 1897, *Rose 2699* GH; Zacatecas, *Coulter 51* GH.

3. ECHINOPEPON WRIGHTII (Gray) Wats., Bull. Torrey Club 13:158, 1887. *Elaterium wrightii* Gray, Pl. Wright [Smiths. Contr. Knowl.] 5 part 2:61. 1853. Type: "Mts. at Guadalupe Pass, Oct. . . . Oregon Mts., near El Paso, May, 1851," *Wright 1090* (UC!, photographs KMS!, fig. 2; isotypes US! 2 at GH!). *Echinocystis* (section *Echinopepon) wrightii* (Gray) Cogn., Mem. Acad. Sci. Belg. 28:88. 1878. *Micrampelis wrightii* (Gray) O. Ktze., Rev. Gen. 1:257. 1891.

Stems 0.5 to 2 mm. in diam., glandular-pubescent, the internodes 5–15 cm. long; leaf blades cordate, 3–9 cm. in diam., the terminal apex acuminate or acute, other apices commonly obtuse, the basal sulci to 2 cm. wide, about 0.75 as deep, the margin almost entire to shallowly 3–5 lobed, at times somewhat undulate or broadly dentate, both surfaces finely hispid; petioles 2–5 cm. long, pubescent; tendrils trifid (or bifid), pubescent, on peduncles 2–4 cm. long; staminate flowers in racemes or occasionally in panicles, 8–20 flowers per raceme, the racemes 6–12 cm. long, flowers usually clustered at distal 1–3 cm.; pedicels 3–12 mm. long, several often arising from one point, flexuous; calyx lobes linear-lanceolate, 0.25–0.5 mm. long, greenish; corolla broadly campanulate, to almost rotate, (6) 7–8 (9) mm. in diam., tube greenish in young flowers, often conspicuously 10-lined, the lobes unequal, nearly deltoid to broadly lanceolate, obtuse, 3–4 mm. long, 1.5–2.5 mm. wide at the base, the margins and inner surfaces conspicuously glandular, the glands frequently reddish; stamens with anther heads sub-globose, 1–1.5 mm. in diam., 0.67 as thick, smooth, with 5 vertical lines, the filament columns 1.5 mm. long, slender; pistillate calyx lobes linear-lanceolate, 0.2–0.67 mm. long, greenish; corolla campanulate, 9–11 mm. broad, the lobes deltoid to broadly lanceolate, 3–4 mm. long, 1.5–2.5 mm. wide at the base; stigmas 0.75 to 1.5 mm. in diam., about one half as thick; style 1 mm. long; fruit ovoid-cylindrical, exclusive of beak 20–30 mm. long, 10–15 mm. in diam.; beak 10–15 mm. long; fruit and beak somewhat villose; spines 3–15 (30) mm. long; peduncles slender, 5–15 mm. long; seeds oblong-obovoid, dorso-ventrally flattened, apex truncate, narrow at the base, 5–7 mm. long, 3.5–4 mm. wide, 1–2 mm. thick, conspicuously rugose, brown.

In the United States in southeastern Arizona and southern New Mexico, thence south in Mexico in Sonora and Sinaloa (fig. 5).

Representative specimens seen. ARIZONA. Pima County: Baboquivari Mountains, Sept. 19, 1931, *Jones* CAS, DS, POM, UC; near reservoir, Mendoza Canyon, Coyote Mountains, elev. 3,200 feet, Oct. 5, 1946, *Gould 3940* ARIZ, US, CAS, GH; 8 miles south of Vail, elev. 4,000 feet, Aug. 31, 1903, *Jones* DS, POM, US. Santa Cruz County: near Nogales, Aug. 28, 1927, *Peebles & Harrison 4729* US. NEW MEXICO. Otero County or Eddy County: mountains near El Paso, at Guadalupe Pass, 1852, *Wright 1090* GH, US. MEXICO. SONORA: grassland, elev. 2,900 feet, 9 miles west of La Angostura, August 19, 1941, *White 4036* GH; Agua Zarca, south of Colonia Morelos, elev. 3,400 feet, Sept. 19, 1941, *White 4449* GH; Los Esqueros, elev. 4,900 feet, Oct. 15, 1890, *Hartman 168* GH, US; Río Magdalena, eight miles east of junction of Cananea road and highway, Sept. 9, 1934, *Wiggins 7067* DS; Magdalena, 9 miles northeast of Imuris, Sept. 9, 1934, *Shreve 6621* ARIZ; gravely flat, elev. 2,350 feet, 2.5 miles north of Matape on road to Batuc, Sept. 11, 1941, *Wiggins & Rollins 465* DS, GH, UC; shrub zones on the canyon floors, west slope of the Sierra Madre, El Río Bonito about Nopalera, Municipio de Nacore Chico, Oct. 4, 1939, *Muller 3617* GH, UC; shrub-grassland, mesa, with cholla, near Navajoa, Oct. 27, 1939, *Gentry 4754* AHFH, DS, GH; wash, 5 miles east of Sacaton crossing on road to Ures, Sept. 18, 1934, *Wiggins 7297* DS, GH; along banks of dry stream, along water course 5 miles south of San Rafael, Oct. 21, 1932, *Wiggins 5925* DS, US; mesquite, grassland, Valle de Teras, Rio de Bavispe region, Aug. 28, 1940, *Phillips 754* GH. SINALOA: Yerba Buena near Culiacan, Oct. 15, 1904, *Brandegee* UC. Yerracito, near Culiacan, Sept. 26, 1904, *Brandegee* UC.

4. ECHINOPEPON MINIMUS (Kell.) Wats., Proc. Am. Acad. Arts & Sci. 24:52. 1889. *Marah minima* Kell., Proc. Calif. Acad. Sci. ser. 1, 2:18, 1863.

Stems to 1 mm. in diam., glabrous or nearly so, often with a bloom, the nodes glabrous to more or less clothed with hyaline hairs, these to 6 (10) mm. long, the internodes 4–12 cm. long; leaf blades cordate, to 6 (10) cm. broad, about as long, shallowly 3–5-lobed to more or less deeply 5-lobed, the apices acuminate, acute, to obtuse, the basal sulci broad open to somewhat closed, the margins almost entire to serrulate or dentate, the upper surfaces scabrous, often with mineralized white papillae, or nearly glabrous, the lower surfaces more nearly glabrous; petioles 1–3 (6) cm. long, glabrous; tendrils filiform-bifid, on peduncles 1–3 (4) cm. long, glabrous; staminate flowers 6–12 (20) per raceme, racemes (2) 3–6 (12) cm. long; pedicels 3–12 (20) cm. long, several often arising from one point, sparingly hispid to glandular pubescent; calyx lobes 0.2 to 0.5 mm. long, filiform or subulate, greenish; corolla campanulate, 5–7 (9) mm. in diam., lobes unequal, to 4 (5) mm. long; 2–3 (5) mm. wide at the base, acute or obtuse, conspicuously glandular on margins and within; stamens with anther mass thickened-discoid, to 2 mm. in diam., and 1 mm. thick, edged with 5 symmetrical U-shaped locules, the anther column to 1.5 mm. long; pistillate flowers 5–6 (7) mm. broad; calyx lobes 0.33–0.4 mm. long, linear-subulate to filiform; corolla lobes 2.5 (3) mm. long and 1 (2) mm. wide at the base, apices obtuse, conspicuously glandular on the margin and within; stigma globose 1 (1.4) mm. in diam., surface glandular; style 1 mm. long; fruit oblong-obovoid, exclusive of beak 6–12 (15) mm. long, 6–7 mm. in diam., beak 4–7 mm. long; fruit and beak almost glabrous, very slightly pubescent; spines 4 mm. long, 0.6 mm. in diam. at the base, peduncles 1–3 (8) cm. long; upper portion of seed rectangular, basal portion narrower, thinner and retuse, 3–3.5 (5) mm. long, 1–1.5 mm. wide, 1–1.2 mm. thick, smooth, black, with transverse, brown, raised markings.

KEY TO VARIETIES

Peduncles 1–3 cm. long; leaves not deeply dissected . . . . . a. var. *minimus*
Peduncles 4–8 cm. long; leaves deeply dissected . . . . b. var. *peninsularis*

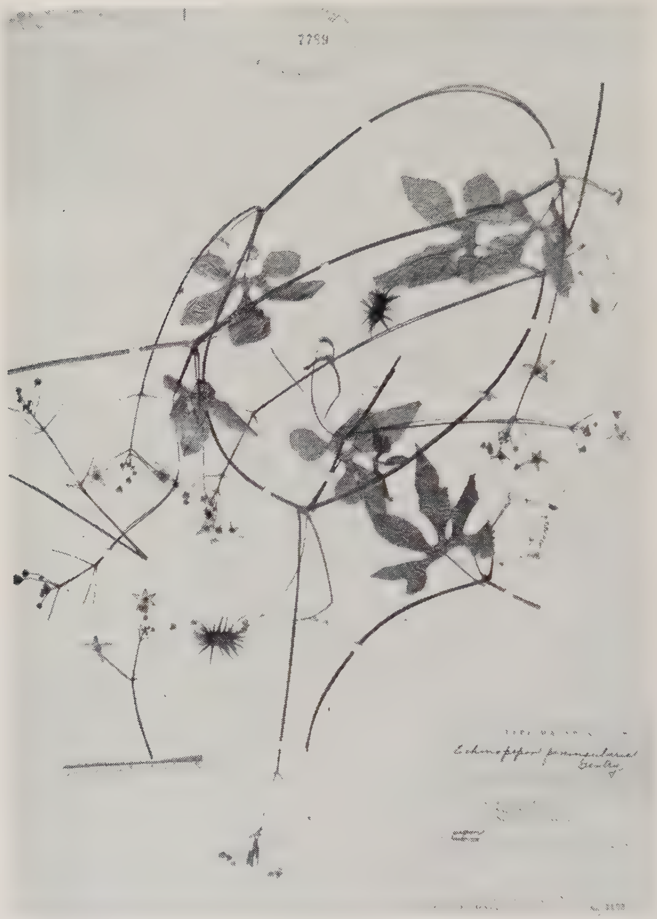

Fig. 4. *Echinopepon minimus* var. *peninsularis,* type, *Dawson 1193* AHFH.

4a. ECHINOPEPON MINIMUS (Kell.) Wats., Proc. Amer. Acad. Arts & Sci. 24:52. 1889. var. **minimus** nom. nov. Type: Cerros [Cedros] Island, Mr. John A. Veatch. The type specimen may have been destroyed by the San Francisco fire of 1906. The following specimen represents the author's concept of the species and may be taken as a lectotype. *Streets* (US! isotype GH! photographs KMS! fig. 3) *Elaterium minimum* Wats., Proc. Amer. Acad. Arts & Sci. 12:252. 1877. *Echinocystis* (section *Echinopepon*) *minima* Cogn., D.C. Monogr. Phan. 3:805. 1881. *Micrampelis minima* O. Ktze., Rev. Gen. 1:257. 1891.

Nodes lacking conspicuous hyaline hairs; leaf blades not deeply dissected, to 6 cm. in diam.; staminate racemes 3–6 cm. long, flowers to 7 mm. in diam.; fruit with beak to 16 mm. long, peduncle less than 2 cm. long; seeds not over 3 mm. long.

Known only from Cedros Island, Mexico (fig. 5).

Representative specimens seen: MEXICO. Baja California. Cedros Island: March-June, 1897, *Anthony 299* DS, GH, UC, US; April 7, 1897, *Brandegee* UC; March 14, 1939, *Elmore A12* AHFH; March 18–20, 1889, *Palmer 719* GH, US; March 12, 1911, *Rose 16163* GH, US; July 18, 1905–1906, *Stewart 31* CAS; 1876, *Streets* GH, US.

The intergradation between var. *minimus* and var. *peninsularis* is so complete that there are more intergrades than members of either variety. Dr. H. S. Gentry, who named *E. peninsularis* a species, looked over the division presented herewith of specimens into var. *minimus, peninsularis,* and intermediate groups. He agreed with this division, but considers *minimus* and *peninsularis* as separate species which readily intergrade (fig. 3).

The following collections are examples of these intergrades. MEXICO. Baja California: Agua Colorado to Cerro Colorado, elev. 100–500 feet, Dec. 15, 1905, *Nelson & Goldman 7320* US; Arroyo de Tecolote near lava flow, sandy valley, southern Vizcaino Desert . . . with *Olneya* . . ., Nov. 19–21, 1947, *Gentry 7845* AHFH, UC, US; Barril, on Gulf coast, latitude 28 degrees, 20 minutes, Feb. 28, 1935, *Shreve 6986* AHFH; Cape Region, 1901, *Dorffer* UC; Cerralvo Islands, April 19, 1911, *Rose 16890* US; Espiritu Santo Island, April 1, 1931, *Collins, Kearney & Kempton* 129 US; on *Machaerocereus* on gravelly slopes, 37 miles northeast of Pozo Aleman, Feb. 28, 1935, *Wiggins 7800* DS, UC; Sierra Giganta above Puerto Escondido, April 21, 1938, *Gentry 3747* AHFH, GH; La Purisima Canyon, 13 miles west of Canipolé, Nov. 17, 1946, *Wiggins 11451* AHFH; San Jose del Cabo, Jan.-March, 1901, *Purpus* UC; Santa Margarita Islands, March 3, 1889, *Brandegee* UC; eastern bajada of Sierra Calvario, Systema de Sierra Viscaino, March 10–15, 1947, *Gentry 7370* AHFH, UC; Todos Santos, Feb. 15, 1928, *Jones 24120* ARIZ, CAS, DS, UC. Sinaloa: Los Mochis, Jan. 30, 1927, *Jones* UC; San Blas, Jan. 30, 1927, *Jones* CAS.

4b. Echinopepon minimus (Kell.) Wats. var. **peninsularis** (Gentry) stat. nov. *Echinopepon peninsularis* Gentry, Allan Hancock Pac. Exp. 13:170. 1949. Type: San Jose del Cabo, Cape District, Baja California, Mexico, *Dawson 1193* (AHFH!, photograph KMS! fig. 4.)

Nodes with quite conspicuous hyaline hairs; leaf blades deeply 5-lobed, to 10 cm. in diam.; staminate racemes to 12 cm. long; flowers 8–12 mm. in diam.; fruit with beak 17–22 mm. long; peduncles more than 2 cm. long; seeds more than 3 mm. long.

Southern District of Baja California, Mexico (fig. 5).

Representative specimens seen. MEXICO. Baja California: La Paz, Jan. 20–Feb. 5, 1890, *Palmer 65* GH, US; Cape San Lucas and surrounding area, Aug., 1859-Jan., 1860, *Xantus* GH; San Jose del Cabo, Sept. 27, 1890, *Brandegee* UC; edge of broad arroyo and sand dunes near ocean, on *Jatropha* and *Machaerocereus gummosus,* 19.2 km. southwest of San Jose del Cabo, Dec. 17, 1947, *Carter, Alexander, & Kellogg 2248* AHFH, UC; San Jose del Cabo, Cape District, *Dawson 1193* AHFH; Todos Santos, Sept. 18, 1893, *Brandegee* UC; rocky canyon bottom under oaks, shade, Arroyo Hondo, Sierra Giganta, Dec. 13, 1938, *Gentry 4125* ARIZ, DS, GH, UC.

5. Echinopepon cirrhopedunculatus Rose, Contr. U.S. Nat. Herb. 1:100. 1891. Type: "Common about Alamos. . . ." southern Sonora, Mexico, *Palmer 634,* 1890 (US 43926!, photographs KMS!, fig. 3; isotype GH!).

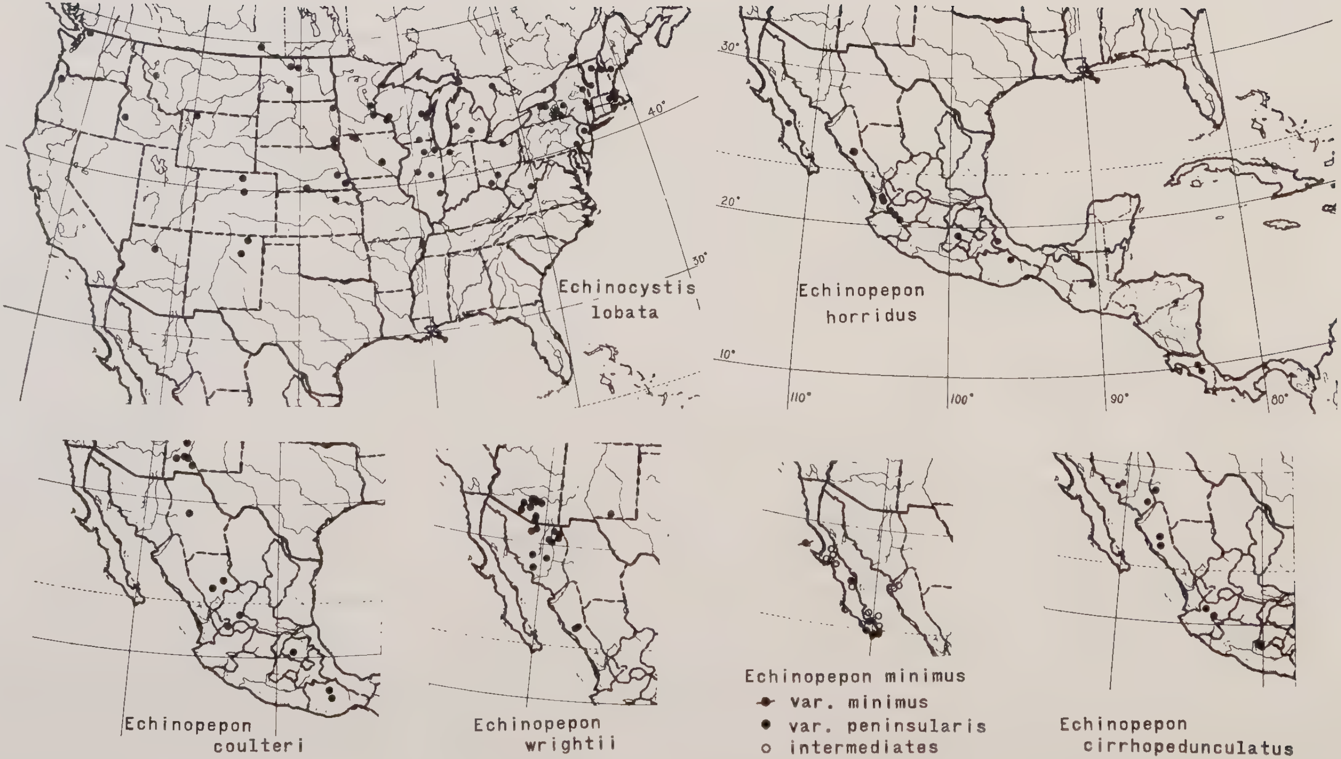

FIG. 5. Distribution maps of species of *Echinocystis* and *Echinopepon*.

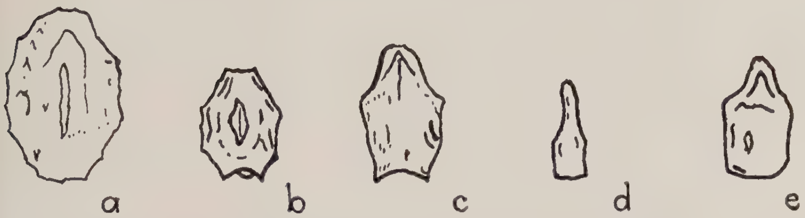

Fig. 6. Seeds of *Echinopepon* species: *a, E. horridus* (*Pringle 4563* US); *b, E. coulteri* (*Coulter 51* GH); *c, E. wrightii* (*Wright 1090* GH); *d, E. minimus* var. *minimus* (*Palmer 719* GH); *e, E. cirrhopedunculatus* (*Pringle 4562* GH). All × 2.

Stems slender, 1–1.5 mm. in diam., the internodes 6–15 cm. long, glabrous except for rather conspicuous tufts of hyaline trichomes at the nodes; trichomes to 6 mm. long; leaf blades cordate, 3–7 cm. wide, a few somewhat longer than wide, usually distinctly 5-lobed, the triangular central lobe often twice as long as others, the basal sulcus usually deeper than broad, to 1.5 mm. deep, 0.5–1 mm. broad, the central apex usually acute, others usually obtuse, the margins denticulate-dentate, the upper surfaces muricate, veins hispid, the lower almost glabrous; petioles 2–3.5 cm. long, with few short heavy hairs; tendrils commonly bifid, on peduncles 1–2 cm. long, glabrous; staminate flowers 10–30 per raceme, racemes slender, 5–15 cm. long, pedicels to 20 mm. long, several often arising at one point on peduncle; flowers small, calyx lobes subulate 0.17–0.33 mm. long, not quite as wide at base, greenish; corolla campanulate, 4–7 mm. in diam., lobes triangular, somewhat obtuse, 1.5–2 mm. long, almost as broad, glands rather inconspicuous; stamens with anther mass globose, 1 mm. in diam., not quite as long, the filament column 1 mm. long; pistillate calyx lobes broadly subulate to 0.25 mm. long; corolla open campanulate, to 8 mm. broad, lobes oblong-ovate to 1 mm. long, 0.5 mm. wide at base, apices acute-obtuse, both surfaces minutely glandular; stigma thick, discoid, 0.67 mm. in diam., 0.4 mm. thick; style slender to 1 mm. long; fruit oblong-elliptic, cylindrical, exclusive of beak 25–35 mm. long, 8–12 mm. in diam., the beak 12–18 mm. long, glabrous, the spines slender, to 1 cm. long; peduncle tendril-like, springy, 4–12 cm. long when coiled; seeds oblong, apex notched, truncate, base slender, 5 mm. long, 3 mm. wide, 2 mm. thick, somewhat tuberculate, dark brown.

Central and western Mexico in the states of Chihuahua, Jalisco, Mexico, Sinaloa, Sonora (fig. 5).

Representative specimens seen. MEXICO. Chihuahua: valley margin slope, Guasaremos, Río Mayo, Aug. 3, 1936, *Gentry 2355* ARIZ, GH, UC, US. Jalisco: on road between Bolaños and Guadalajara, Sept. 22, 1897, *Rose 3052* US; banks, Tequila, Oct. 3, 1839, *Pringle 4562* GH, UC, US. Mexico: barranca, Chacamerito, Dist. Coyuca, Aug. 14, 1934, *Hinton 6438* GH; Ipericones, Temascaltepec, Sept. 23, 1935, *Hinton 8483* AHFH, GH. Sinaloa: Cerro Colorado, vicinity of Culiacan, Nov. 3, 1904, *Brandegee* UC; slope, under shrubbery, oak-*Ipomoea* savannah, elev. 3,000 feet, Las Mesas, Sierra Surotato, Sept. 15, 1941, *Gentry 6657* GH. Sonora: infrequent, around milpas, Alamos, Oct. 29, 1939, *Gentry 4783* AHFH, ARIZ, DS, UC; Alamos, Sept. 16–30, 1890, *Palmer 634* GH, US; weedy flat, 11 miles northeast of Colorado, between Colorado and Mazatan, Sept. 6, 1941, *Wiggins & Rollins 335* DS, GH; moist swale, 10 miles south of Mazatan, Sept. 7, 1941, *Wiggins & Rollins 367* AHFH, DS, GH, UC.

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MOSSES OF CALIFORNIA V. PTERIGONEURUM OVATUM AND P. SUBSESSILE

LEO FRANCIS KOCH

Pterigoneurum ovatum (H.) Dixon was reported by the author (1949) as unrepresented in California, although it was known to occur in other western states and as far east as North Dakota, Wyoming, Utah, New Mexico, and Texas (Wareham, 1939). *Pterigoneurum subsessile,* given by Wareham as occurring in "Western North America, east to Illinois," also was reported by the author as unrepresented in the flora of California (Koch, 1950), although it was mentioned by Sullivant (1856) as growing there and investigators later assumed its presence. Nevertheless, Californian collections of these two species did not seem to exist in any of the herbaria whose specimens were available to the author.

On 24 January 1952, plants of both species (*Koch 4029, 4026*) were found at the southern fringe of Bakersfield 5 miles west of U. S. Highway 99, Kern County. The southern end of the Great Valley does not drain into the San Joaquin River. It is an independent basin without an outlet to the sea and the vegetation is properly classified as an "Alkali Sink Community" of the "Southern Desert" biotic province by Munz and

Keck (1949). Its low altitude of about 400 meters above sea level and lack of drainage no doubt contribute to its floristic peculiarity. The area is dominated by scattered trees of *Populus fremontii* S. Wats. and *Prosopis juliflora* DC. var. *glandulosa* Cocker, although most of the ground surface below is covered with a thick growth of *Distichlis spicata* (L.) Greene. Associated with them are species of *Atriplex* and other halophytes like *Suaeda* and *Anemopsis*. As in most of California, rain in this area occurs largely during the winter months. The growth of annual vascular plants is usually delayed until average daily temperatures rise in February or March. In addition to *Pterigoneurum ovatum* and *P. subsessile,* two other mosses were collected here on 24 January 1952: *Tortula brevipes* (Lesq.) Broth. (*Koch 4027*) and *Aloina rigida* (H.) Kindb. var. *pilifera* (Br. & Schp.) Schp. (*Koch 4025*). All four mosses apparently accomplish sexual reproduction before the associated vascular plants break dormancy completely.

Both species of *Pterigoneurum* are relatively uncommon in this locality although the material collected contained an abundance of mature sporophytes with calyptrae attached. Undoubtedly a special search over a wide area would have uncovered a great number of colonies of the two species. The other two mosses collected, on the other hand, were present in great abundance and almost each colony of them was found to have produced sporophytes. The specimens cited are in the author's collection. Mr. E. B. Bartram confirmed the identity of *P. subsessile.*

In addition to their American range, both species of *Pterigoneurum* have also been reported from wide areas in Europe and from the Caucasus. In addition, Algiers, Mesopotamia, and Persia are also given by Brotherus (1924) as being within the range of *P. ovatum.* Thus the addition of these two mosses to the known moss flora of California augments the already large number of species included in the "Three Boreal Continents" Division of Koch (1954). It seems likely that both species of *Pterigoneurum* will be discovered in other desert regions within the state.

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CHROMOSOME NUMBERS IN MENTZELIA (LOASACEAE)

Henry J. Thompson and Harlan Lewis

The species of *Mentzelia* in Section *Trachyphytum* have been variously delimited in the manuals and floras of California and the most recent taxonomic revision of the genus (Darlington, 1934), but none of these treatments has proved adequate for the identification of all the taxa, particularly those on the California deserts. For several years the junior author, together with his students in an advanced systematics course, have made population studies and chromosome counts of taxa in Section *Trachyphytum* in an attempt to ascertain species limits and the basis of the taxonomic confusion. It soon became evident that polyploidy and to some extent interspecific hybridization were both contributors to the problem. More recently the senior author has extended the earlier observations and has examined the chromosomes of species in sections *Bartonia* and *Mentzelia*. It is the purpose of this paper to present our observations of chromosome numbers in the genus and to indicate their relationship to the delimitation of the various taxa.

The chromosome numbers obtained and their source are shown in the accompanying table. The basic number of the genus is apparently 9. All of the chromosome numbers are reported for the first time except *M. lindleyi* which was first published by Sugiura (1936). Our counts were made from microsporocytes fixed in acetic alcohol (1:3) and squashed in aceto-lacmoid or aceto-orcein. Permanent slides and herbarium sheets of the material examined are on file in the herbarium of the University of California, Los Angeles, except for the collection of *M. multiflora* (*Munz 11714*) which is in the herbarium of the Rancho Santa Ana Botanic Garden. We are grateful to Dr. Munz for furnishing buds of this species.

Section Trachyphytum. This section consists of several apparently well defined species which are morphologically quite uniform, and two variable species groups, one of which includes a polyploid complex. One of the morphologically well defined species, *Mentzelia micrantha* (H. & A.) T. & G. has been examined cytologically. It is diploid (n=9), consisting of small-flowered plants with smooth, angular seeds and it is the only species in this section with dilated outer filaments. *Mentzelia micrantha* is one of the least variable species of the section and occurs in cismontane California and adjacent Baja California, Mexico.

One of the variable species groups includes the taxa which have been described as *Mentzelia affinis* Greene and *M. dispersa* Wats. Together they are clearly separated from the remainder of the section discussed below by the conformation of the seeds which are smooth, angular, and with grooves along the margins. However, the taxa within this group are at present not clearly defined. The two chromosome counts that we have obtained, both diploid (n=9), are apparently best referred to *M. affinis.*

The remaining group of closely related and often variable species is characterized by rounded, papillose seeds and includes diploid, tetraploid, hexaploid, and octaploid taxa. This group has most often been considered to be five species, but such a treatment does not account for several more or less constant morphological types. Furthermore, the morphological differences are correlated with differences in chromosome number which indicate a genetical discontinuity. In general we have assigned names to the material we have examined in this group in accordance with the classification of Abrams (1951) in which seven species were recognized.

We have found four species to be diploid, two tetraploid, one hexaploid, and one octaploid. Three of the diploid species ($n=9$), *Mentzelia gracilenta* T. & G., *M. pectinata* Kell., and *M. nitens* Greene, have large flowers with petals 10–25 mm. long. The first two species occur west of the Sierra Nevada axis and differ conspicuously in flower color. *Mentzelia pectinata* has bright orange-red flowers while those of *M. gracilenta* are yellow to cream. *Mentzelia nitens* occurs only on the desert and has bright yellow flowers. The fourth diploid species, *M. congesta* (Nutt.) T. & G., can be recognized by its congested inflorescence with membranous bracts and small yellow flowers with petals about 5 mm. long. In California *M. congesta* is restricted to the mountains, occurring generally above 6000 feet. The two tetraploid species ($n=18$) are *M. Lindleyi* T. & G. and *M. veatchiana* Kell. *Mentzelia lindleyi* is a large-flowered species with petals 20–40 mm. long in which there are two morphogeographic units that differ slightly in a number of characteristics. *Mentzelia lindleyi* subsp. *lindleyi* has relatively broad petals that are a golden yellow with a prominent orange spot at the base. It is endemic to the inner coast ranges of central California and is often grown as an ornamental. It is from cultivated material that the chromosome number was first determined by Sugiura (1936). *Mentzelia lindleyi* subsp. *crocea* Wolf has more narrow petals that are yellow with a less obvious orange spot at the base. It is endemic to the foothills of the western slope of the southern Sierra Nevada. *Mentzelia veatchiana* and all of the other polyploids, except *M. lindleyi,* form a complex which is confined to the deserts or the mountains marginal to them. *Mentzelia veatchiana* has petals 7–12 mm. long which are intermediate between those of the diploid species on the one hand, and those of the hexaploid ($n=27$) and octaploid ($n=36$) species on the other. The hexaploid species *M. albicaulis* Doug. and the octaploid species *M. gracilis* (Rydb.) Thompson and Lewis[1] are comparable in flower size with petals 3–6 mm. long, but they differ conspicuously in leaf shape. The characteristic leaves of *M. albicaulis* have shallow and regularly scalloped margins while those of *M. gracilis* are irregularly divided. The correlation between higher chromosome number and smaller flower size in this desert group is of particular interest because it is comparable to that found in

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[1] **Mentzelia gracilis** (Rydb.) Thompson and Lewis comb. nov., based upon the type of *Acrolasia gracilis* Rydberg, Bull. Torrey Club 31:566. 1904. *J. H. Cowen,* June 1, 1895, foothills, Larimer County, Colorado, NY!

TABLE I. MENTZELIA COLLECTIONS EXAMINED CYTOLOGICALLY

Species	Chromosome Numbers (n)	Collector	Locality
SECT. TRACHYPHYTUM			
M. micrantha	9	*Thompson 1559,* June 11, 1953	San Gabriel Canyon at West Fork, Los Angeles Co., Calif.
M. micrantha	9	*R. Snow,* June 23, 1953	9.6 mi. N. of Wheeler Hot Springs, Ventura Co., Calif.
M. affinis	9	*H. Lewis,* May 2, 1952	Between Coalinga and Panoche Pass, Fresno Co., Calif.
M. affinis	9	*Thompson & H. Lewis 1557,* June 3, 1953	5.5 mi. E. of Edison, Kern Co., Calif.
M. gracilenta	9	*H. Lewis & M. Lewis,* May 1, 1952	10 mi. W. of Simler, San Luis Obispo Co., Calif.
M. gracilenta	9	*H. Lewis & M. Lewis,* April 30, 1952	Cuyama Valley near Ventura-Santa Barbara Co. line, Ventura Co., Calif.
M. pectinata	9	*H. Lewis & M. Lewis,* April 19, 1952	Kern River Canyon, 0.2 mi. from mouth, Kern Co., Calif.
M. pectinata	9	*Thompson & H. Lewis 1589,* April 10, 1954	Temblor Range, W. of Maricopa, Kern Co., Calif.
M. pectinata	9	*Thompson & H. Lewis 1590,* April 11, 1954	W. slope of Temblor Range at Crocker Grade, San Luis Obispo Co., Calif.
M. nitens	9	*H. Lewis,* April 8, 1950	Atolia, San Bernardino Co., Calif.
M. nitens	9	*Thompson, H. Lewis, & Mathias 1599,* April 17, 1954	Near Red Rock Canyon, Kern Co., Calif.
M. congesta	9	*Thompson 1624,* May 29, 1954	Summit of Mt. Pinos, Ventura Co., Calif.
M. lindleyi subsp. *lindleyi*	18	*Thompson 1569,* July 15, 1953	Cultivated strain, UCLA Botanical Garden
M. lindleyi subsp. *lindleyi*	18	*Thompson & H. Lewis 1616,* May 15, 1954	Adobe Creek at del Puerto Road, Stanislaus Co., Calif.
M. lindleyi subsp. *crocea*	18	*Thompson & H. Lewis 1620,* May 16, 1954	Merced River, 6 mi. above Bear Creek, Mariposa Co., Calif.
M. lindleyi subsp. *crocea*	18	*W. Ernst,* August 20, 1953	Plants grown at UCLA from seeds collected at Amphitheater Point, Sequoia National Park, Calif.
M. veatchiana	18	*H. Lewis & M. Lewis,* April 5, 1952	Aqueduct Rd., 5.8 mi. E. of Garnet, Riverside Co., Calif.

Species	Chromosome Numbers (n)	Collector	Locality
M. veatchiana	18	*Thompson 1563,* June 12, 1953	Above Crystal Lake, San Gabriel Mts., Los Angeles Co., Calif.
M. veatchiana	18	*Thompson 1629,* June 25, 1954	S. side of Big Bear Lake, San Bernardino Co., Calif.
M. albicaulis	27	*H. Lewis,* April 8, 1950	Atolia, San Bernardino Co., Calif.
M. gracilis	36	*H. Lewis & M. Lewis,* April 5, 1952	Cottonwood Springs Rd. near Hwy. 60, Riverside Co., Calif.
Sect. Biscuspidaria			
M. involucrata	9	*H. Lewis & M. Lewis,* April 5, 1952	Cottonwood Springs Rd. near Hwy. 60, Riverside Co., Calif.
Sect. Bartonia			
M. multiflora	9	*Munz 11714,* April 10, 1947	Turtle Mts., San Bernardino Co., Calif.
M. laevicaulis	11	*Thompson 1568,* July 10, 1953	Lebec, Kern Co., Calif.
M. laevicaulis	11	*Thompson 1565,* July 15, 1953	Big Tujunga Wash near Sunland, Los Angeles Co., Calif.
M. laevicaulis	11	*Thompson 1573,* Oct. 1, 1953	Crystal Lake, San Gabriel Mts., Los Angeles Co., Calif.
M. laevicaulis	11	*Thompson & H. Lewis, 1555,* May 25, 1953	North Fork of San Jacinto River, Riverside Co., Calif.
M. laevicaulis	11	*Thompson & H. Lewis 1617,* May 17, 1954	Del Puerto Road near Adobe Creek, Stanislaus Co., Calif.
M. laevicaulis	11	*Richard Shaw,* July 17, 1954	Jackson, Teton Co., Wyo.
Sect. Mentzelia			
M. arborescens	14	*Thompson 1581* March 2, 1954	Cultivated plant Vavra Estate, UCLA.

the desert species of *Eschscholtzia* (Lewis and Snow, 1951) and may in both cases be associated with breeding habit.

The polyploid species of *Mentzelia* on the desert sometimes form hybrid swarms. For example, in a particular locality one may find morphological intergradation between *M. veatchiana* and *M. albicaulis* due apparently to interspecific hybridization (e.g. *Lewis* in 1950, one mile south of Atolia, San Bernardino Co., Calif.) although in most areas these species retain their integrity. Interspecific hybridization between polyploid species is undoubtedly a contributor to the variation which tends to obscure specific limits in this group.

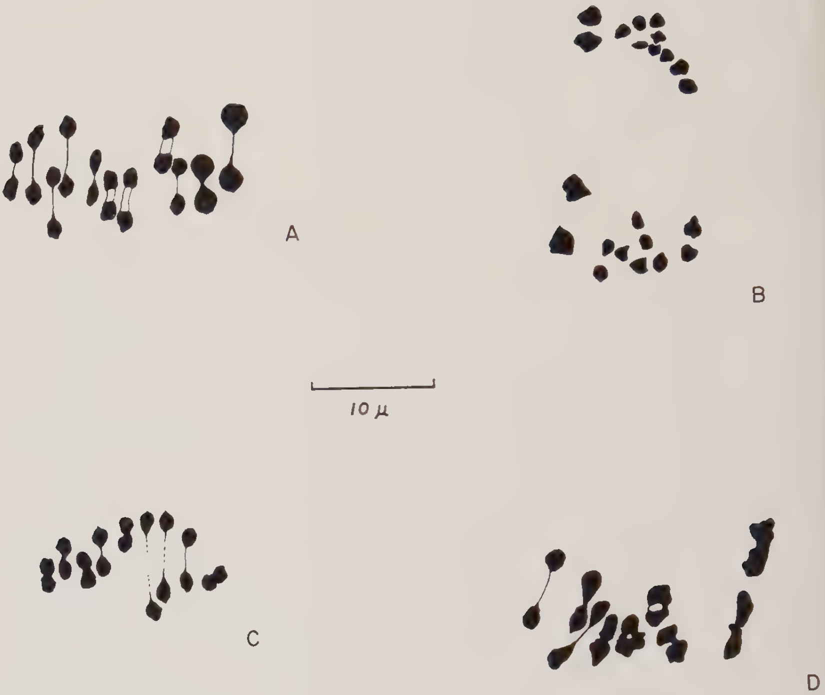

FIG. 1. *Mentzelia* microsporocyte meiosis. A, *M. laevicaulis* M_I. B, *M. laevicaulis,* A_I. *C, M. affinis,* M_I. *D, M. multiflora,* M_I. Camera lucida drawings. All material fixed and treated in the same manner.

SECTION BICUSPIDARIA. One species in this section, *Mentzelia involucrata* Wats. has been examined cytologically and found to be diploid (n=9).

SECTION BARTONIA. We have examined two species in this section, *Mentzelia multiflora* (Nutt.) Gray and *M. laevicaulis* (Doug.) T. & G. Both species are diploid, but the former has 9 pairs of chromosomes while *M. laevicaulis* has 11 pairs. Populations of the latter species which have been examined cytologically have come from six rather widely separated localities. This indicates that the deviation from the usual basic number of 9 is not merely a local variation. Of particular interest, however, is that the chromosomes of *M. laevicaulis* fall into two size classes. At meiosis nine of the chromosome pairs are relatively small and more or less uniform in size while two pairs are conspicuously larger (fig. 1A, B). This suggests that two relatively large chromosomes have been added to a normal diploid complement in the formation of *M. laevicaulis*. Interestingly enough, different species of *Mentzelia* are apparently characterized by chromosomes of different size (fig. 1C, D). This suggests that *M. laevicaulis* may be the product of interspecific hybridization whereby two chromosomes of one of the parental species have been added to the complete genome of the other. Speciation correlated with the addition of the equivalent of whole chromosomes is now well established for the genus *Clarkia* (Lewis 1953a, b, and 1954) and will be further investigated in *Mentzelia.*

Section Mentzelia. One species in this section, *Mentzelia arborescens* Urban & Gilg has been examined cytologically and found to have 14 pairs of chromosomes. These chromosomes are all approximately the same size and do not fall into two distinct size classes as in *M. laevicaulis.*

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CHROMOSOME COUNTS IN THE SECTION SIMIOLUS OF THE GENUS MIMULUS (SCROPHULARIACEAE)

Robert K. Vickery, Jr.

This report[1] on the determination of chromosome numbers in the section *Simiolus* of the genus *Mimulus* is an integral part of a long range investigation into the taxonomy, genetics, and evolution of species in *Mimulus* (Vickery, 1951). The chromosome study was undertaken in order to improve our understanding of the many genetic barriers known to be present in the genus, particularly the ones in the most intensively studied section, *Simiolus* (Vickery, 1952). *Mimulus* chromosomes are small, averaging about three-fourths of a micron long by one-half micron wide and are therefore relatively difficult to study. Hence, it was necessary to develop a special technique for this investigation.

The chromosome counts were obtained by smearing anthers and observing meiosis in the pollen mother cells. The procedure consisted of

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[1] The work was supported by the Research Fund of the University of Utah. The author wishes to thank Drs. Ira L. Wiggins, William M. Hiesey, and Jens Clausen for their helpful criticisms of the manuscript.

Table 1. Chromosome Counts in Mimulus, Section Simiolus

	New Counts
$n = 14$	*M. guttatus* DC. Pacific Grove, Monterey County, California, altitude 5 feet, *Vickery 1* (5001). Chew's Ridge, Monterey County, California, altitude 4500 feet, *Vickery 3* (5004). Wendover, Tooele County, Utah, altitude 4300 feet, *W. P. Cottam,* June 6, 1953 (5852). Salt Lake City, Salt Lake County, Utah, altitude 4400 feet, *Vickery 330* (5834). Fish Haven, Bear Lake County, Idaho, altitude 6100 feet, *Vickery 332* (5837).
$n = 14$	*M. tilingii* Regel Little Cottonwood Canyon, Salt Lake County, Utah, altitude 8800 feet, *Vickery 337* (5846).
$n = 14$	*M. glabratus* var. *utahensis* Pennell Mono Lake, Mono County, California, altitude 6440 feet, *Stebbins 714* (5048).
	Previously Reported Counts
$2n =$ ca. 64	*M. luteus* L. and its horticultural varieties, *M. tigrinus* and *M. tigrinoides* (Brozek, 1932).
$2n = 48$	*M. guttatus* DC. (Maude, 1939).
$n = 14$	*M. guttatus* DC., var. *typicus* Campbell, var. *gracilis* Campbell, var. *grandis* Greene (Campbell, 1950).
$n = 14$	*M. guttatus* DC. (G. L. Stebbins, Jr., personal communication). Mount Diablo, Contra Costa County, California, altitude 1000 feet. *Stebbins 703* (5052).
$n = 14$	*M. nasutus* Greene (G. L. Stebbins, Jr., personal communication). Hastings Reservation, Monterey County, California, altitude 1800 feet, *Stebbins 701* (5044).

fixing buds in a fluid made up of two parts absolute ethanol to one part propionic acid. Fixations were made from 2:00 to 3:00 p.m. as that was apparently the optimum time. The proper bud size for fixation varied from 1.0 to 6.5 millimeters depending upon the particular race. The buds were left in the fixative for approximately one hour and then were transferred to a propio-orcein stain for approximately 30 minutes. The stain consisted of a 2 per cent solution of natural orcein dye in 45 per cent propionic acid. After staining, the small buds were smeared directly while the large buds were dissected and only the anthers smeared. The slides were put in an ethanol vapor chamber and then transferred to an ethanol bath to complete the dehydration. They were mounted in a synthetic resin, "Permount," supplied by the Fischer Scientific Company. The con-

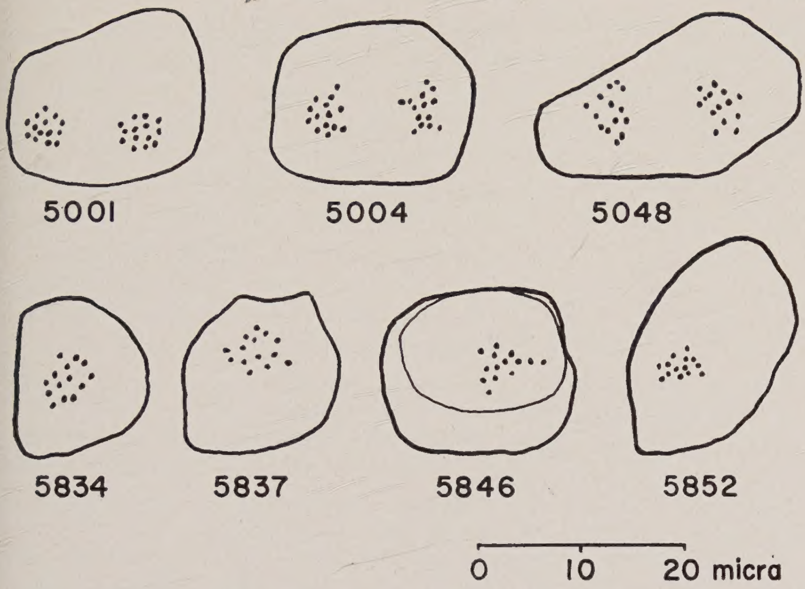

FIG. 1. Meiotic chromosomes of pollen mother cells of *Mimulus*. All are n = 14. Cultures 5001, 5004, 5834, 5837, 5852 represent different forms of *M. guttatus* while 5846 is a form of *M. tilingii* and 5048 of *M. glabratus* var. *utahensis*. The plants of 5834 and 5837 are in first metaphase while all the others are in second metaphase. For cultures in second metaphase the two figures were drawn only if the counts were clear in both. The camera lucida drawings were made at an original magnification of 1,750 diameters.

trast between the chromosomes and the cytoplasm improved for the first two days after staining and was still good after several months.

Pressed specimens of all the forms counted have been prepared for future reference and will be deposited in the Dudley Herbarium of Stanford University and the Garrett Herbarium of the University of Utah. The chromosome numbers were found to be n=14 in the three species studied. The various forms of these species come from localities ranging from sea level to 8,800 feet altitude (see Table 1). The numbers in parentheses in Table 1 are the author's culture numbers and serve as cross references for these forms in papers presenting the results of the experimental work.

Campbell (1950), Stebbins (personal communication), and the present author agree that the chromosome numbers of the North American races of *M. guttatus* are n=14 in contrast to Maude's (1939) report of 2n=48 for material presumably of European origin. It will be interesting if this high but unrelated number of chromosomes is verified. There are strong indications that some of the American races have higher polyploid numbers although no unambiguous counts are presently available.

The chromosome counts reported here indicate that some of the strong genetic barriers in the section *Simiolus* (Vickery, 1952), namely, those between *M. guttatus, M. tilingii,* and *M. glabratus,* are probably due to gene or cryptic structural differences rather than to differences in chromosome number. However, the latter reason appears to be the cause of the complete genetic barrier between these species and *M. luteus.* Work is in progress to obtain additional chromosome counts of the races and species of *Mimulus* in order to further our understanding of the nature of the many genetic barriers of various degrees known to be present in the genus.

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NOTES ON NEVADA MIMULUS

GABRIEL EDWIN

In the course of preparing the Scrophulariaceae for "Contributions Toward a Flora of Nevada," a few situations in *Mimulus* have come to my attention that require clarification.

MIMULUS BIGELOVII GRAY

MIMULUS BIGELOVII Gray var. OVATUS Gray, Syn. Flora No. Am. ed. 2, Vol. 2, Pt. 1: Suppl. 445. 1886. *Eunanus cusickii* Greene, Pittonia 1:36. 1887; *Mimulus cusickii* (Greene) Piper, Contr. U. S. Nat. Herb. 11:508. 1906; *Mimulus bigelovii* var. *cuspidatus* Grant, Ann. Mo. Bot. Gard. 11:279–280. 1924.

Grant (1924, pp. 281–282) maintained *Mimulus cusickii* (Greene) Piper and included in it, as a synonym, *M. bigelovii* var. *ovatus* Gray in its entirety. She also presented the new variety *M. bigelovii* var. *cuspidatus.* Study of the type specimens of *M. bigelovii* and *M. bigelovii* var. *cuspidatus* and of the specimens upon which the descriptions of *M. bigelovii* var. *ovatus* and *M. cusickii* were presumably based as well as study of general collections (mostly from Nevada) indicate that Greene's and Grant's entities can be considered conspecific with *M. bigelovii* var. *ovatus* and their proposed names treated as synonyms.

Piper (1906, p. 508) merely stated that *M. bigelovii* Gray var. *ovatus* Gray was "sufficiently different" (from *M. bigelovii* Gray), and he made it a separate species, *M. cusickii* (Greene) Piper, based on *Eunanus cusickii* Greene. Piper cited only one collection, *Brandegee 1011*. Greene had pointed out that his *Eunanus cusickii* has broadly ovate, very acute leaves, does not have "the pubescence" (of *M. bigelovii* Gray), and is otherwise different. However, he included *M. bigelovii* var. *ovatus* Gray as a synonym, at least in part. Grant amplified the description of *M. cusickii* (Greene) Piper as follows: longer and stouter stems, closely sessile leaves and differences in the calyx throat and in the exsertion and pubescence of the style. Gray in his original description of var. *ovatus* had considered it "more rigid," taller, with closely sessile leaves having apiculate-acuminate tips.

Greene did not designate any type for *Eunanus cusickii,* but cited the collections of Cusick and Howell in Washington and Oregon. Gray likewise had established no type for his var. *ovatus,* citing Torrey's Nevada collection and those of Nevius, Hall, and Howell, "northward to the Columbia River." Pennell, in a pencilled note on the sheet containing Torrey's collection, considered Nevius' collection to be the type of var. *ovatus*. Grant designated Torrey's collection as lectotype of var. *ovatus,* and annotated the sheet containing Nevius' and Howell's collections as *M. cusickii* (Greene) Piper. Since neither Gray nor Greene established definite types for *M. bigelovii* var. *ovatus* and *Eunanus cusickii* respectively, interpretation of the names must be based upon the material cited in the original descriptions. Along with these, subsequent collections are valuable checks and aids.

The sheets containing the originally cited collections of Torrey, Howell, and Nevius (Gray Herbarium) clearly show that *M. bigelovii* var. *ovatus* Gray and *Eunanus cusickii* Greene are morphologically identical. Although these three collections differ in stature from each other, they are not in general very much taller than the typical *M. bigelovii*. The leaves on these collections vary gradually from narrow, one-nerved, non-apiculate, non-cuspidate-tipped, with tapering narrowly sessile base, as in the typical *M. bigelovii,* to broad (ovate), 3–5 nerved, cuspidate-tipped, with little-tapering, broadly sessile base, as in var. *ovatus (Eunanus cusickii)*. Thus the broad leaf with closely sessile base is found in varying degrees on the collections of Torrey, Howell, and Nevius, and this is also true of the cuspidate tip.

The variations in the calyx orifice, fruit size, style exsertions, and pubescence of these three collections are minimal and within the limits of the typical *M. bigelovii*. The pubescence does not vary discernibly from one to the other, and is only slightly different from that of *M. bigelovii*.

Grant's type specimen of *M. bigelovii* var. *cuspidatus* has pedicels up to 8 mm. long (but mostly 3–6 mm.). The pedicels of var. *ovatus* are shorter. However, some collections of *M. bigelovii* Gray show pedicels approaching the length of those in the type specimen of var. *cuspidatus*.

In all other respects *M. bigelovii* var. *cuspidatus* Grant is the same as *M. bigelovii* var. *ovatus* Gray. In my judgment the pedicel length alone is insufficient to maintain var. *cuspidatus* separate from var. *ovatus*.

MIMULUS EASTWOODIAE RYDB.

In her monograph, Grant divided *Mimulus* into two clearly defined sub-genera and split these into several sections. Among the sections in the subgenus *Synplacus* Grant are *Erythranthe* Greene and *Paradanthus* Grant. These are separated from each other primarily on the length of the calyx teeth, those of *Erythranthe* being 4–6 mm. long while those of *Paradanthus* do not exceed 3 mm. in length. Secondary characters dividing the two are exserted stamens and uninflated calyces at maturity in *Erythranthe*, as opposed to included stamens and occasionally inflated calyces in *Paradanthus*.

Mimulus eastwoodiae Rydb. (Bull. Torrey Club 40: 483. 1913) was placed in *Paradanthus* by Grant. Examination of three sheets of the type collection of this species clearly shows calyx teeth 4–6 (8) mm. long, exserted stamens and uninflated calyx at maturity.

Therefore, it appears that *M. eastwoodiae* Rydb., based on the characters cited, belongs in *Erythranthe* rather than *Paradanthus*.

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NOTES AND NEWS

MONOCHORIA VAGINALIS IN CALIFORNIA. While visiting the Biggs Rice Station (California Cooperative Rice Research Foundation), Butte County, in August 1954, Mr. William A. Harvey, Extension Specialist in Weed Control, noted an unfamiliar weed in several of the experimental plots. It was not in flower at the time, and the specimens which he collected could not be identified. In September, however, flowering specimens were obtained. We observed that in most cases the inflorescences did not project above the surface, the flowers actually opening under water. Cleistogamous pollination was clearly indicated in several buds that we dissected.

We identified our specimens (*Harvey, McCaskill, & Tucker 2753*) at the University of California Herbarium, Berkeley, as *Monochoria vaginalis* (Burm. f.) Presl. No New World collections were present, but ours proved a good match for specimens from Oahu, Formosa, and Kwangtung Province, China. This species is evidently widespread in India and southeast Asia, and is reported as a frequent inhabitant of rice paddies.

Its occurrence in Butte County is probably very limited as yet, the only colonies noted being north of the Rice Station or in its immediate vicinity. Although perhaps only a waif as yet, it seems to compete well with other water weeds, and with rice where the stands are thin. It is considered worth reporting here, therefore, since it is evidently new to the United States, if not, indeed to North America.—J. M. TUCKER and B. J. MCCASKILL, Department of Botany, University of California, Davis.